



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/681,186	02/14/2001	Gerd Schneider	21295/21	8480

29127 7590 07/14/2003

HOUSTON ELISEEVA
4 MILITIA DRIVE, SUITE 4
LEXINGTON, MA 02421

EXAMINER

KAO, CHIH CHENG G

ART UNIT	PAPER NUMBER
----------	--------------

2882

DATE MAILED: 07/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/681,186

Applicant(s)

SCHNEIDER ET AL. 

Examiner

Chih-Cheng Glen Kao

Art Unit

2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 21 April 2003 is: a) ☐ approved b) ☒ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- ☐ Interview Summary (PTO-413) Paper No(s) _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other:

DETAILED ACTION

Drawings

1. The proposed drawing correction filed on 4/21/03 has been disapproved because it is not in the form of a pen-and-ink sketch showing changes in red ink or with the changes otherwise highlighted. See MPEP § 608.02(v). Please also note the proposed drawings and corrected drawings must be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

Specification

2. The disclosure is objected to because of the following informalities: On Page 6, paragraph 21, the specification refers to specific claims ("claim 1" and "claim 11"). Any possible amendment to the claims may make this information inaccurate. This objection may be obviated by specifically reciting the actual limitations being referenced. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 2882

3. Claims 1-3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. (US Patent 5222113) in view of Levine et al. (Tomographic reconstruction of an integrated circuit interconnect), Nagai et al. (US Patent 5533083), and Iketaki (US Patent 5450463).

4. With regards to claims 1 and 12, Thieme et al. discloses a method and x-ray microscope (Title) for examining a structure having a thickness (Fig. 1, #4) comprising penetrating and imaging with x-rays (Fig 1) with an objective (col. 1, lines 40-45, and col. 3, lines 40-45).

However, Thieme et al. does not disclose examining structures on a semiconductor substrate, imaging on a spatially resolving detector, establishing a wavelength or range as a function of the thickness of the sample such that transmission of x-rays is at least sufficient for detection and obtaining an image.

Levine et al. teaches examining structures on a semiconductor substrate (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2). Nagai et al. teaches imaging on a spatially resolving detector (col. 2, lines 5-18). Iketaki teaches establishing a wavelength or range as a function of the thickness of the sample (col. 2, lines 49-55, and col. 21, lines 40-55).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to examine structures on a semiconductor substrate of Levine et al. with the method and device of Thieme, since one would be motivated to incorporate to provide inspection (Page 150, col. 1, first paragraph) as implied from Levine et al.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to image with spatially resolving detectors of Nagai et al. with the method

Art Unit: 2882

and device of Thieme, since one would be motivated to secure images of various data as implied from Nagai et al. (col. 2, lines 5-18).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to establish a wavelength or range as a function of the thickness of the sample of Iketaki with the method and device of Thieme, since one would be motivated to increase quality or contrast of an image as implied from Iketaki (col. 2, lines 34-40).

5. With regards to claim 2, Thieme et al. in view of Levine et al., Nagai et al., and Iketaki suggests a method as recited above.

However, Thieme et al. does not disclose reducing the thickness of a substrate to examine metal structures.

Levine et al. teaches reducing the thickness of a substrate (Abstract, lines 1-2) to examine metal structures (Page 150, col. 2, lines 1-2).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to reduce the thickness of a substrate of Levine et al. with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to image just the important features of a structure as implied from Levine et al. (Page 150, col. 1, last line, and col. 2, lines 1-11).

6. With regards to claim 3, Thieme et al. in view of Levine et al., Nagai et al., and Iketaki suggests a method as recited above.

However, Thieme et al. does not disclose the substrate made of silicon having less than 30um thickness and x-radiation wavelength between 0.1 to 2nm.

Levine et al. teaches the substrate made of silicon (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2) having less than 30um thickness (Abstract, lines 1-2). Iketaki teaches x-ray wavelength between 0.1 and 2nm (col. 1, lines 25-31).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have a substrate made of silicon of Levine et al. with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since it would have been within general skill of a worker in the art to select a known material on the basis of its suitability. One would be motivated to have silicon for a substrate, since silicon has long been recognized as a preferred substrate material.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have less than 30um thickness of Levine et al. with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to image just the important features of a structure as implied from Levine et al. (Page 150, col. 1, last line, and col. 2, lines 1-11). Note that wherein the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have wavelength between 0.1 to 2 nm of Iketaki with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to use smaller wavelengths to reduce damage and observe with high resolution as

Art Unit: 2882

implied from Iketaki (col. 1, lines 20-26). Note that wherein the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

7. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Levine et al., Nagai et al., and Iketaki as applied to claim 1 above, and further in view of Schneider (Dissertation).

8. With regards to claim 4, Thieme et al. in view of Levine et al., Nagai et al., and Iketaki suggests a method as recited above.

However, Thieme et al. does not disclose wavelength selected by Rayleigh-Gans algorithms for scattering.

Schneider teaches wavelength selected by Rayleigh-Gans algorithms for scattering (Page 1, lines 8-14).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have wavelength selected by Rayleigh-Gans algorithms for scattering of Schneider with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to use this phase information derived from Rayleigh-Gans algorithms to operate at even shorter wavelengths as implied from Schneider (Page 2, lines 4-6), which is advantageous for viewing even smaller structures.

Art Unit: 2882

9. With regards to claim 5, Thieme et al. in view of Levine et al., Nagai et al., and Iketaki suggests a method as recited above.

However, Thieme et al. does not disclose metal structures on a substrate nor wavelengths based on absorption discontinuities.

Levine et al. teaches metal structures on a substrate (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2). Schneider teaches wavelength based on absorption discontinuities (Page 2, lines 1-4).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the metal structures of Levine et al. with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since it would have been within general skill of a worker in the art to select a known material on the basis of its suitability. One would be motivated to use have metal structures to use as connections or wires to connect components in a semiconductor device as implied from Levine et al. (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have wavelength based on absorption discontinuities of Schneider with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., Iketaki, and Levine et al., since one would be motivated to use the absorption discontinuities or windows to obtain good amplitude contrast as implied from Schneider (Page 2, lines 1-4) for a better image.

Art Unit: 2882

10. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Levine et al., Nagai et al., and Iketaki as applied to claim 1 above, and further in view of Oka et al. (JP 02-203261).

Thieme et al. in view of Levine et al., Nagai et al., and Iketaki suggests a method as recited above.

However, Thieme et al. does not disclose x-rays impinging on the substrate at a side containing no structures.

Oka et al. further teaches x-rays impinging on the substrate at a side containing no structures (Fig. 1b).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have x-rays impinging on at a side containing no structures of Oka et al. with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to impinge the side with no structures to image the structures within a package (Fig. 1b) as implied from Oka et al.

11. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Levine et al., Nagai et al., and Iketaki as applied to claim 1 above, and further in view of Wilkins (US Patent 6163590).

Thieme et al. in view of Levine et al., Nagai et al., and Iketaki suggests a method as recited above.

However, Thieme et al. does not disclose imaging at different angles to allow stereographic and tomographic reconstruction.

Art Unit: 2882

Levine et al. teaches imaging at different angles (Abstract) to allow tomographic reconstruction (Title). Wilkins teaches imaging at different angles to allow stereographic reconstruction (col. 11, lines 17-27).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have tomographic reconstruction of Levine et al. with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to image in 3 dimensions as implied from Levine et al. (Page 150, col. 1, lines 1-3), which will reveal more information than a two-dimensional image.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have stereographic reconstruction of Wilkins with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to image in 3 dimensions as implied from Wilkins (col. 11, lines 17-27), which will reveal more information than a two-dimensional image.

12. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Levine et al., Nagai et al., and Iketaki as applied to claim 1 above, and further in view of Schmahl et al. (Proposal for a Phase Contrast Microscope).

Thieme et al. in view of Levine et al., Nagai et al., and Iketaki suggests a method as recited above.

However, Thieme et al. does not disclose operating in phase contrast to provide minimal exposure.

Art Unit: 2882

Schmahl et al. teaches operating in phase contrast to provide minimal exposure (Page 237, col. 2, lines 1-5).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have phase contrast of Schmahl et al. with the suggested method of Thieme et al. in view of Levine et al., Nagai et al., and Iketaki, since one would be motivated to use it for minimal exposure (Page 237, col. 2, lines 1-5).

13. Claims 9, 10, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Levine et al., Nagai et al. ('083), and Iketaki as applied to claim 1 and 12 above, and further in view of Schmahl et al. and Nagai et al. (US Patent 5434901).

14. With regards to claims 9 and 13, Thieme et al. in view of Levine et al., Nagai et al. ('083), and Iketaki suggests a method and device as recited above.

However, Thieme et al. does not disclose a segmented phase plate in a back focal plane of the objective.

Schmahl et al. teaches a phase plate in a back focal plane of the objective (Fig. 16.1). Nagai et al. ('901) teaches a segmented phase plate (Fig. 4, #37a and 37b).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the phase plate in the back focal plane of Schmahl et al. with the suggested method and device of Thieme et al. in view of Levine et al., Nagai et al. ('083), and Iketaki, since one would be motivated use it for amplifying the image (Page 233, lines 1-2) as implied from Schmahl et al.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the segmented phase plate of Nagai et al. ('901) with the suggested method of Thieme et al. in view of Levine et al., Nagai et al. ('083), and Iketaki, since one would be motivated use it for better viewing low contrast objects (col. 9, lines 34-41) as implied from Nagai et al. ('901).

15. With regards to claims 10 and 14, Thieme et al. in view of Levine et al., Nagai et al. ('083), Iketaki, Schmahl et al., and Nagai et al. ('901) suggests a method and device as recited above.

However, Thieme et al. does not disclose a segmented stop before a condenser.

Nagai et al. ('901) teaches a segmented stop before the condenser (Fig. 3B, #22b and 22).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to segmented stop before the condenser of Nagai et al. ('901) with the suggested method and device of Thieme et al. in view of Levine et al., Nagai et al. ('803), Iketaki, Schmahl et al., Nagai et al. ('901), since one would be motivated to have a stop before the condenser to control or isolate light (Fig. 3B) as implied from Nagai et al. ('901) into the condenser, which creates less interference in the signal.

16. Claims 11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Levine et al., Nagai et al. ('083), Iketaki, Schmahl et al., and Nagai et al. ('901) as applied to claims 10 and 14 above, and further in view of Schmal et al. (US Patent 5550887).

Art Unit: 2882

Thieme et al. in view of Levine et al., Nagai et al. ('083), Iketaki, Schmahl et al., and Nagai et al. ('901) suggests a method and device as recited above.

However, Thieme et al. does not disclose a segmented annular condenser zone plate used as a condenser.

Schmal et al. teaches a segmented annular zone plate as the condenser (col. 2, lines 45-50).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the zone plate of Schmal et al. with the suggested method and device of Thieme et al. in view of Levine et al., Nagai et al. ('083), Iketaki, Schmahl et al., and Nagai et al. ('901), since one would be motivated to use it to focus the x-ray radiation on the sample (col. 2, lines 44-46) as implied from Schmal et al.

Response to Arguments

17. Objections to the claims have been withdrawn in light of the Amendment made of record on 4/21/03.

18. Applicant's arguments with respect to claim 1-15 have been considered but are moot in view of the new ground(s) of rejection.

Art Unit: 2882

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (703) 605-5298. The examiner can normally be reached on M - F (9 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (703) 308-4858. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



gk
June 26, 2003



EDWARD J. GLICK
Supervising Patent Examiner
TECHNOLOGY CENTER 2800